DEFENSE NUCLEAR AGENCY

Submission of Proposals

The Defense Nuclear Agency is seeking small businesses with a strong research and development capability and experience in nuclear weapon effects, phenomenology and operations. (Note: we are not interested in nuclear weapon design or manufacture.) DNA invites the small business community to send proposals directly to the following address:

Defense Nuclear Agency
ATTN: AM/SBIR
6801 Telegraph Road
Alexandria, VA 22310-3398

The proposals will be processed, then distributed to the appropriate technical office for evaluation. Questions concerning the administration of the SBIR program and proposal preparation should be directed to:

Defense Nuclear Agency
ATTN: AM, Mr. Billy Burks
6801 Telegraph Road
Alexandria, VA 22310-3398
Tel: (703) 325-5021

DNA has identified 24 technical topics, numbered DNA 94-01 through DNA 94-24, to which small businesses may respond in this solicitation (94.1). Please note that these are the only topics for which proposals will be accepted. The current topics and the full topic descriptions are included below. These topics were initiated by DNA technical offices which manage the research and development in these areas. Note several of the topics are intentionally broad to ensure any innovative idea which fits within the mission of DNA may be submitted. Proposals do not need to cover all aspects of these broad topics. Questions concerning the research topics should be submitted to:

Defense Nuclear Agency
ATTN: OTA, Mr. James M. Gerding
6801 Telegraph Road
Alexandria, VA 22310-3398
Tel: (703) 325-1217

DNA selects proposals for funding based upon technical merit, criticality of the research, and evaluation criteria contained in this solicitation document. As funding is limited, DNA reserves the right to select and fund only those proposals considered to be superior in overall technical quality and most critical. As a result, DNA may fund more than one proposal in a specific topic area if the technical quality of the proposals are deemed superior; or it may fund no proposals in a topic area. Proposals which cover more than one DNA topic should only be submitted to DNA once.

DNA has not set aside funds for bridge funding. As such, proposers should not rely upon bridge funding to cover the time gap between Phase I and Phase II.

Subject Index to the DNA SBIR Solicitation

DEFENSE NUCLEAR AGENCY
FY 1994 SBIR TOPIC INDEX

SURVIVABILITY AND HARDENING

SENSORS

COMMUNICATIONS NETWORKING

ENERGY STORAGE

ENVIRONMENTAL EFFECTS

MUNITIONS DEVICES AND ENERGETIC MATERIALS
DNA 94-022 Advanced Lethality Technologies

ELECTRONIC DEVICES
DNA 94-023 Radiation Hardening of Microelectronics

DEFENSE NUCLEAR AGENCY

FY 1994 TOPIC DESCRIPTIONS

DNA 94-001 TITLE: Nuclear Weapon Effects Calculation and Presentation

CATEGORY: Exploratory Development, Survivability and Hardening

OBJECTIVE: Improve the accuracy, runtime, or visualization of output of nuclear weapon effects calculations.

DESCRIPTION: Accurate, efficient, user-friendly methods of calculation of nuclear weapon effects and display/presentation of such calculations are of major concern to DNA. Areas of interest include more accurate calculations, faster running calculations, desktop versions (where appropriate) to enable use by a wide audience, and new and improved ways to enable users (be they advanced nuclear weapons effects researchers, weapon systems developers, or managers with limited nuclear weapons effects experience) to calculate, estimate, and appreciate nuclear weapon effects and the survivability/ vulnerability of structures and equipment to these effects. Nuclear weapon effects include airblast; ground shock; water shock; cratering; thermal radiation; neutron, gamma and x-ray radiation; electromagnetic pulse; fallout; blueout; blackout; redout; dust cloud formation; and the effects of these on personnel, materials and structures. Structures of interest include deep underground, land-based, sea-based, and aerospace structures.

During Phase I, the research will demonstrate the feasibility of the proposed methodology to calculate and display/present nuclear weapon effects and/or the response of materials and structures to these effects.

During Phase II, the research concepts developed in Phase I will be further developed where, if appropriate, the concepts will be incorporated into appropriate codes.

COMMERCIAL POTENTIAL: Computer codes related to earthquake effects, pollution transport.

DNA 94-002TITLE: Response of Materials to Nuclear Weapon Effects

CATEGORY: Exploratory Development, Survivability and Hardening

OBJECTIVE: Measure the response of new and existing materials to nuclear weapon effects and develop methods to improve the survivability of these materials.

DESCRIPTION: Of interest to DNA is the response of materials, structures, and systems to nuclear weapons effects. Materials of interest include metals, ceramics and composites. New materials capable of being used as a structural members for aircraft, missiles, ships, submarines and military vehicles are of particular concern. The response of underground structures such as missile silos, command and control facilities and communications facilities are especially important. Concepts and techniques which will improve the survivability (decrease the response) of these types of systems to nuclear weapons effects are required.

New materials with enhanced electromagnetic shielding properties are also of interest.

During Phase I, testing plans and feasibility studies on the material will be completed.

During Phase II, the material will be tested and conclusions from the test results will be drawn.

COMMERCIAL POTENTIAL: Material improvements for structures, aircraft and vehicles.

DNA 94-003TITLE: Nuclear Weapon Effects on Electronics and Communications

CATEGORY: Exploratory Development, Survivability and Hardening

OBJECTIVE: Explore the effects of nuclear weapon explosions on electronics and communications.

DESCRIPTION: The nature and magnitude of the effects produced by the interaction of nuclear weapon produced radiation on electronics, electronic systems, opto-electrical devices, sensors, and communication systems in the phenomenology areas of a) Transient Radiation Effects on Electronics (TREE); b) Electromagnetic Pulse (EMP); c) System Generated EMP (SGEMP); and d) atmospheric effects (blackout, redout, etc.) are of interest to DNA. Particular areas of concern include; methods by which designers of space, strategic and tactical systems can assess their susceptibility to these effects; technologies to reduce the susceptibilities of electronic systems and devices (especially those with submicron feature sizes) to acceptable levels; and methods to demonstrate survivability under specified threat criteria. Concepts and techniques to improve the survivability (decrease the response) of systems against these nuclear weapons effects are required.

During Phase I, initial feasibility studies will be completed to demonstrate the viability of the proposed approach.

During Phase II, continue the investigate began in Phase I to fully develop the proposed approach.

COMMERCIAL POTENTIAL: Commercial satellites and electromagnetic interference/compatibility.

DNA 94-004TITLE: Nuclear Weapon Effects Simulation

CATEGORY: Exploratory Development, Survivability and Hardening

OBJECTIVE: Improve the state-of-the-art in nuclear weapon effects simulation.

DESCRIPTION: Simulators are needed to: (1) provide experimental data for development of numerical simulations of nuclear weapons effects; (2) simulate one or more nuclear weapons effects at laboratory size scale; (3) predict what will occur during an underground nuclear test; (4) calibrate gauges used in the large scale simulators; (5) develop new gauges; and (6) dust lofting tests (centrifuges).

Simulation requirements include airblast over various surface conditions, dusty flow, dust lofting, shock propagation in rock, water shock, thermal radiation, EMP, and nuclear radiation.

Existing large scale simulators are often expensive and time consuming to operate, and require travel to an explosive test site. Small scale simulators are needed to provide extensive data to supplement the limited amount of data available from the large scale simulators. Innovative simulators are needed which are economical and simple to operate. Innovative ideas are needed on how to use very small scale simulators to produce useful information. A joint proposal with a government laboratory may be helpful because the simulator can then remain at the government laboratory where it will be readily available for future use.

During Phase I, build the basic simulator and demonstrate that it functions properly.

During Phase II, use the simulator to produce useful data and improve the simulator as necessary.

COMMERCIAL POTENTIAL: Numerical analysis and metrology.

DNA 94-005TITLE: Instrumentation

CATEGORY: Exploratory Development, Survivability and Hardening

OBJECTIVE: Develop new instrumentation or improve existing instrumentation used in nuclear weapon effect simulators and in underground nuclear testing.

DESCRIPTION: Instrumentation is used for measuring nuclear weapon effects, phenomenology parameters, the response of test items exposed to real or simulated nuclear weapon effects and control of advanced accelerators used to simulate weapon effects. The instrumentation should be capable of operating under very harsh conditions, such as might be encountered in underground nuclear tests, high explosive tests, or tests involving high levels of x-ray, gamma, or neutron radiation. Instrumentation is needed for the following types of tests: airblast, dusty flow, dust lofting, water shock, shock propagation in rock, HE, nuclear radiation thermal radiation, electromagnetic pulse (EMP), and

underground nuclear tests and for data acquisition. Desirable improvements in capability include improved reliability, ease of operation, ease of calibration (preferably on site) and improved maintainability.

During Phase I, build a prototype instrument or instrument system and demonstrate its performance in laboratory tests.

During Phase II; design, build, and test a full scale instrument system demonstrating its performance in its intended working environment. This may involve coordination with DNA to schedule testing in a simulator or underground nuclear test.

COMMERCIAL POTENTIAL: Metrology

DNA 94-006TITLE: Structural Response to Nuclear Weapon Effects

CATEGORY: Exploratory Development, Survivability and Hardening

OBJECTIVE: Improve the design and hardness assessment of structures to weapons effects.

DESCRIPTION: Improved designs of hardened structures are needed as well as a better understanding of failure mechanisms of structures. Type of structures include deep underground, land-based (fixed and mobile), sea-based (floating and submerged) and aerospace structures. Designs are needed to resist conventional as well as nuclear weapons effects. Improved methods are needed for analysis and model testing of structures to large deflection and collapse damage levels.

During Phase I, the research will demonstrate the feasibility of the proposed designs/methodology to determine structural response to nuclear weapon effects.

During Phase II, the research concept developed in Phase I will be further developed where, if appropriate, the concepts will be incorporated into other existing methodology/codes.

COMMERCIAL POTENTIAL: Earthquake resistant buildings and improved ship, plane, and vehicle design.

DNA 94-007TITLE: Nuclear Hardening and Survivability

CATEGORY: Exploratory Development, Survivability Hardening

OBJECTIVE: Develop techniques to improve the nuclear hardening and survivability of defense systems.

DESCRIPTION: Techniques for nuclear hardening and survivability of systems, structures, or personnel against nuclear weapons effects are required. These techniques should protect the structure or system against the combined effects of blast, thermal, nuclear radiation, and in the cases of structures or materials, and should also provide protection against electromagnetic and radiation effects wherever any electronic capabilities are involved. In particular, the ability to harden communications facilities and surveillance sensors against electromagnetic pulses is required. Systems include planned and operational strategic and tactical ground mobile systems, missiles, aircraft, spacecraft and their subsystems and components.

During Phase I, demonstrate the feasibility and usefulness of the proposed technique.

During Phase II, fully develop the proposed technique and characterize its usefulness in both technical and cost terms.

COMMERCIAL POTENTIAL: Improved buildings, electronics, aircraft, satellites and better electromagnetic shielding

DNA 94-008TITLE: Security of Nuclear Weapons

CATEGORY: Exploratory Development, Sensors

OBJECTIVE: Improve the security of US nuclear weapons against all types of threats.

DESCRIPTION: Measures to improve the security of nuclear weapons against all possible threats are required. These methods are expected to include weapon storage facility designs, transportation facility designs, new security sensors and sensor system development, methods to improve the secure handling of nuclear weapons, and methods to improve the effectiveness and efficiency of nuclear weapon security operations. Security measures include detection, assessment, and denial systems. Proposals should describe how they will improve protection against known and predicted threats and should emphasize weapon concealment where appropriate.

During Phase I, demonstrate the feasibility and potential usefulness of the proposed security measures.

During Phase II, fully develop the proposed security measures so they can be compared to existing techniques.

COMMERCIAL POTENTIAL: Commercial Security Systems

DNA 94-009TITLE: Theater Nuclear Forces (TNF) Survivability

CATEGORY: Exploratory Development, Survivability and Hardening

OBJECTIVE: Improve the survivability of US nuclear weapons.

DESCRIPTION: The prelaunch survivability (PLS) of the TNF is of vital concern. New and innovative concepts to improve PLS are needed to retain a viable nuclear strike capability and to enhance deterrence. The threats to the TNF include enemy forces conducting unconventional, conventional, chemical and nuclear warfare during periods of peacetime, transition to war, and war. Long range program thrusts include peacetime and field storage, deceptive/OPSEC practices, theater nuclear force movements, and operational survivability of theater nuclear systems (aircraft, missiles, and cannon systems). Survivability concepts are warranted for the period of the l990's and beyond. Concepts should employ innovative ideas and make use of new and emerging technologies.

During phase I, demonstrate the feasibility and potential usefulness of the proposed survivability measures.

During Phase II, fully develop the proposed survivability measures so they can be compared to existing techniques.

COMMERCIAL POTENTIAL: Commercial Security Systems

DNA 94-010TITLE: Operational Planning and Targeting

CATEGORY: Exploratory Development, Communications Networking

OBJECTIVE: Improve the ability of US nuclear commanders to plan for nuclear engagements and target their nuclear weapons.

DESCRIPTION: The nuclear employment planning capabilities of operational commanders in tactical, strategic and integrated warfare environments should be improved. Improvements desired include development of automated planning systems, techniques to determine target damage objective and criteria, post strike target damage assessment capabilities, and automated nuclear weapon employment codes. Techniques to account for electromagnetic effects in operational planning and exercises are also desired.

During Phase I, develop the proposed technique in sufficient detail to demonstrate its feasibility.

During Phase II, continue the development of the proposed technique to the point it can be incorporated into existing planning/targeting methodologies.

DNA 94-011TITLE: Underground Nuclear Testing

CATEGORY: Exploratory Development, Survivability and Hardening

OBJECTIVE: Improve the design, execution, and evaluation of underground nuclear tests.

DESCRIPTION: Underground nuclear effects tests are used in situations for which no suitable above ground simulator exists. Areas of interest include improvements in the design and execution of tests (horizontal/vertical line of sight and cavity), the design of new experiments which extend the capability of current test beds, and innovative test concepts to meet future needs. To improve our understanding of the results improvements to the mathematical methods used to perform various calculations within the test design and analysis program are needed. New methods of characterizing existing materials which are used in critical portions of the test bed (such as the A box) and new materials for such applications, new approaches to the geological problems encountered in the construction of the test beds, and new methods for all test activities (excavation, fabrication, assembly in the tunnel complex, recording data, transmission of data) are also of interest to DNA.

During Phase I, demonstrate the feasibility of the proposed test/experiment improvement. This will be done using laboratory and/or above ground testing.

During Phase II, demonstrate the proposed techniques with underground nuclear testing and/or above ground

testing.

COMMERCIAL POTENTIAL: Improved Satellite Lifetime, mining technology.

DNA 94-012TITLE: Verification Technology Development

CATEGORY: Advanced Development, Sensors

OBJECTIVE: Improve/develop US technical capability to verify/ monitor compliance with existing and potential future arms control treaties and agreements, e.g., START, INF, CW, CFE, NTT, SNF, and Presidential Initiatives.

DESCRIPTION: New arms control measures are being negotiated which could drastically alter existing inventories of nuclear weapons. New verification technologies and methods will be required to accurately monitor compliance to the provisions of any treaties or agreements that could result from the on-going negotiations. The problem will basically involve being able to distinguish between permitted activities and prohibited activities where the technical signatures between the two could be very minor. New technologies and methods of monitoring proliferation of weapons are also required for possible future nonproliferation agreements.

Phase I - Demonstrate the feasibility of the proposed technology in relation to a specific arms control application.

Phase II - Develop a proof of design to demonstrate the proposed technology.

COMMERCIAL POTENTIAL: Inventory Systems, Chemical Monitoring Systems.

DNA 94-013TITLE: Nuclear Weapon Effects on Propagation

CATEGORY: Exploratory Development, Survivability and Hardening

OBJECTIVE: Investigate the effects of nuclear weapon explosions on radio signals and the subsequent performance of communication and radar systems. Investigate the effects of nuclear weapon created optical clutter backgrounds on optical sensor systems. Develop methods to mitigate the above effects. Develop effects simulators to test DoD systems when exposed to those effects.

DESCRIPTION: The Defense Nuclear Agency is interested in the basic physical processes which describe the interaction of nuclear weapons with the atmosphere, which create environments that degrade the propagation of communication and radar signals and that contain optical clutter backgrounds which degrade optical sensor systems. Part of DNA's mission is to predict effects on and determine mitigation methods for DoD systems such as satellite communications, VLF/LF communications, HF/VHF communications, radar systems, and optical sensor systems. Areas of interest include mechanisms for the coupling of nuclear weapon energy to the atmosphere; the development of structure in weapon produced plasmas and molecular emitters; the chemical processes which give rise to the optical emissions; the transport and final deposition of nuclear debris; the effects of degraded signal propagation on the performance of communication systems and radars; and the prediction of the effects of optical clutter backgrounds on the performance of optical sensor systems. Areas of interest also include the development of improved communications and sensor methods to mitigate atmospheric effects on systems and the development and application of simulators to test DoD systems to atmospheric effects.

During Phase I, demonstrate the feasibility of the proposed investigation to advance the understanding in any of the areas described above.

During Phase II, continue the investigation to the development of a product or results that can be incorporated into the existing technology base.

COMMERCIAL POTENTIAL: Commercial communication systems, sunspot effects.

DNA 94-014 TITLE: Novel Application of Pulsed Power Technology

CATEGORY: Exploratory Development, Energy Storage

OBJECTIVE: Development of new applications of existing pulse power technology.

DESCRIPTION: Recent advances in energy storage and switching now make possible the application of DNA pulsed power technology to such areas as armor/anti-armor; electromagnetic/electrothermal guns; mine-countermine; air, surface, and subsurface systems; high power microwave weapons; etc. Concepts proposed should be highly innovative and make full use of the emerging pulse power technology.

During Phase I, demonstrate the feasibility of the proposed pulsed power application.

During Phase II, continue the development of the concept to an engineering model and conduct tests of the effectiveness of the idea.

COMMERCIAL POTENTIAL: Power devices to clean up smoke stack effluents and environmental pollution control.

DNA 94-015TITLE: Advances in Pulsed Power Technology

CATEGORY: Exploratory Development, Energy Storage

OBJECTIVE: Dramatic Improvements in energy storage, switching, and power conditioning state of technology

DESCRIPTION: Future requirements for systems employing pulsed power will necessitate improvements in efficiency, energy density, reliability, repeatability and overall performance. Innovative approaches for component or subsystem development are sought to meet future demands for radiation simulators and other pulsed power applications. Examples include more efficient pulse forming technologies, high energy density capacitors, more efficient insulators, improved and more reliable switching technologies, and improved power flow electrical circuit models. Pulsed power applications include operation at kilovolts to megavolts, kiloamperes to megaamperes, and repetition rates from single pulse to 10 kilohertz.

During Phase I, demonstrate the feasibility of the proposed concept.

During Phase II, develop, test, and evaluate proof-of-principle hardware.

COMMERCIAL POTENTIAL: Power devices to clean up smoke stack effluents and environmental pollution control.

DNA 94-016TITLE: X-Ray Source Development

CATEGORY: Exploratory Development, Survivability and Hardening

OBJECTIVE: Innovative concepts for the production of x-ray radiation used in nuclear weapon effects testing.

DESCRIPTION: Future requirements for x-ray nuclear weapon effects testing will require vast improvements in existing radiation source capability as well as new concepts for producing soft x-rays (1-5 kev), warm x-rays (5-15 kev), and hot x-rays (>15 kev). Soft x-rays are used for optical and optical coatings effects testing. Warm x-rays are used for thermomechanical and thermostructural response testing; and hot x-rays are used for electronics effects testing. The proposer should be familiar with the present capability to produce x-rays for weapon effects testing.

During Phase I, demonstrate the feasibility of the proposed concept.

During Phase II, develop, test, and evaluate proof-of-principle x-ray source capability.

COMMERCIAL POTENTIAL: Satellite lifetime improvement, nuclear reactor instrumentation.

DNA 94-017TITLE: Directed Energy Effects

CATEGORY: Exploratory Development, Survivability and Hardening

OBJECTIVE: Investigate the effects of directed energy and identify materials which may survive effects of directed energy weapons.

DESCRIPTION: The effects of directed energy sources on materials, structures and systems are of interest to DNA. Of particular interest is the establishment of the correlation between nuclear weapons effects and directed energy effects, the identification of materials which are capable of withstanding both nuclear weapons effects and directed energy effects, and mechanisms by which the directed energy sources actually interact with target materials/structures.

During Phase I, demonstrate the feasibility of the proposed investigation.

During Phase II, characterize the effects of directed energy on materials, structures, etc.

COMMERCIAL POTENTIAL: High energy welding

DNA 94-018TITLE: Debris Mitigation

CATEGORY: Exploratory Development, Survivability and Hardening

OBJECTIVE: Develop advanced means of delaying, mitigating, and eliminating debris created from radiation sources in Above Ground Test (AGT) radiation simulators.

DESCRIPTION: Present Plasma Radiation Source (PRS) x-ray sources generate copious amounts of debris (material, atomic charged particles, sub-KeV photons). Debris production will become an even greater concern for the fluence levels of simulators currently under development. Measurements and analysis are required to characterize the source and the debris generated from wire array and z-pinch PRS sources in order to better understand debris sources and mitigation. Existing debris shield systems must be improved to support larger exposure areas and cleaner test environments while minimizing fluence degradation. New methods, or combination of methods, need to be developed to stop, mitigate, and/or delay debris generated for DECADE class radiation simulators.

During Phase I, demonstrate the feasibility of the proposed concept.

During Phase II, develop, test, and evaluate proof-of-principle hardware.

COMMERCIAL POTENTIAL: Very fast closing valves.

DNA 94-019TITLE: X-Ray Simulator Diagnostics

CATEGORY: Exploratory Development, Survivability and Hardening

OBJECTIVE: Develop innovative diagnostics for use in Aboveground Test (AGT) radiation simulators.

DESCRIPTION: Diagnostic systems are used to monitor, measure, record and analyze simulator machine performance, source output, and test asset response. Diagnostics are required for detecting, recording, and evaluating radiation sources for soft (<10 KeV) and hard (>10 KeV) x-rays. Plasma parameters within simulator sub-systems such as plasma opening switches and plasma sources used in radiation simulators. Test response diagnostics are required to measure the full time history of the radiation pulse across the breadth and width of the test asset as well as the response of the test asset during and after irradiation. Pulsed power diagnostics are required for accurate, in-situ measurement of voltages and currents within the various simulator subsystems in order to monitor and characterize simulator performance. Diagnostic systems include required sensors/detectors, cabling, recording equipment and media, and, if necessary, computer systems and software.

During Phase I, design, build and test a prototype diagnostic system in a laboratory environment.

During Phase II, demonstrate the diagnostic system in its working environment on an AGT radiation simulator. This will involve coordination with DNA to schedule testing in a aboveground test simulator.

COMMERCIAL POTENTIAL: Nuclear instrumentation.

DNA 94-020 TITLE: Superconducting Magnetic Energy Storage

CATEGORY: Exploratory Development, Energy Storage

OBJECTIVE: Develop components and systems needed to commercialize Superconducting Magnetic Energy Storage (SMES) technology

DESCRIPTION: DNA solicits proposals for research, developmental engineering, and operational tests leading to commercial Superconducting Magnetic Energy Storage (SMES) systems for transmission, distribution, pulsed power, and load shifting applications. Commercial SMES systems for these applications will be cold-supported (hoop supported), factory manufactured, have storage capacities of 5 - 50 megawatt-hours, and have power ratings of 100 to 1000 megawatts. Suitable topics include, but are not limited to, SMES designs incorporating non-solenoidal coils, liquid helium coolant above 2.2 K, or coolants other than liquid helium; innovative refrigerator designs, including magnetic refrigerators; innovative power conditioning systems; developing high-temperature superconductor down-leads; developing ductile, high-field, high-current, high-temperature superconductors; innovative techniques for collecting helium, or other coolants, following catastrophic quenches; innovative techniques for protecting humans and other fauna from effects of magnetic fields associated with SMES systems; and other, offeror-proposed topics.

During Phase I, demonstrate the viability of proposed approaches. DNA is receptive to discussing developing conceptual designs in Phase I.

During Phase II, successful offerors will develop test, and evaluate proof-of-principle hardware.

COMMERCIAL POTENTIAL: Transmission, distribution, and some pulsed power applications in the electric utility industry, and load shifting and pulsed power applications in the military.

DNA 94-021 TITLE: Forecasting Environments in the Troposphere and Space (FORETS)

CATEGORY: Exploratory Development, Environmental Effects

OBJECTIVE: To investigate the effects of the natural and disturbed environments on atmospheric and space forecasting methods. Develop techniques to mitigate these effects, account for physical processes contributing to chaotic environments, and improve performance predictions.

DESCRIPTION: The Defense Nuclear Agency (DNA) is interested in the basic physical process which describes the effects of the natural and disturbed environment on the employment of various weapon systems. These environments may create situations that degrade the propagation of communication and radar signals, optical sensor systems, and weapon system employment. Part of DNA's mission is to predict effects the environment will have on these systems. Areas of interest include development of models and model predictions to forecast the effects of clouds on the theater of operations; the identification and streamlining of a model for support of theater operation; the development of a coupled space weather model to predict particle fluences and spectra; and the development of cloud and scintillation climatologies.

During Phase I, demonstrate the feasibility of the proposed areas of investigation to advance the understanding in any one of the areas.

During Phase II, continue the investigation leading to the development of models/products that can be incorporated into the existing technology base.

COMMERCIAL POTENTIAL: Weather prediction

DNA 94-022 TITLE: Advanced Lethality Technologies

CATEGORY: Exploratory Development, Munitions Devices and Energetic Materials

OBJECTIVE: Demonstrate innovative applications of advanced non-nuclear technologies for enhanced target lethality or nuclear effects simulations.

DESCRIPTION: Of interest to DNA is the development and demonstration of capabilities which may significantly extend weapons range-to-effect or enhance lethality against hard targets. The response of a hardened bunker complex or of intrinsically hard ballistic missile sub-munition warhead payloads are of particular interest. Novel applications of explosives technology, hyperkinetic technologies, or directed energy (DE) concepts will be of interest.

During Phase I the research will develop concept feasibility through either analysis or laboratory scale demonstration.

During Phase II the concepts will be further developed through more definitive experiments and/or sophisticated computational analyses.

COMMERCIAL POTENTIAL: Hypervelocity, advanced explosives.

DNA 94-023 TITLE: Radiation Hardening of Microelectronics

CATEGORY: Exploratory Development, Electronic Devices

OBJECTIVE: Develop and demonstrate technology to: (1) radiation harden; (2) improve reliability and electrical performance;, (3) improve radiation hardness and reliability assurance methods;, and (4) characterize the radiation and reliability response of semiconductor devices (microelectronics and optoelectronics) including warm and cold operation metal oxide semiconductor (MOS), bipolar, and compound material technologies.

DESCRIPTION: The trend in semiconductor integrated circuits and sensors is toward increasingly higher levels of integration density, higher speeds, higher on-chip circuit complexity, lower voltage and power, and larger die size. All of these trends have exacerbated the problems associated with radiation hardening (i.e., maintaining acceptable levels of performance vice increased hardening), reliability, and testability. In addition, improvements in material science have lead to the introduction of a wide variety of compound semiconductor materials into microelectronic and opto-electronic applications. The radiation and reliability responses of these materials is lacking or unknown.

Thus, it is the objective of this topic to develop and demonstrate innovative methods and technology, for advanced microelectronics and opto-electronics, to (1) ensure that these devices can operate in a radiation environment, (2) improve reliability and capability to operate in stressing environments (e.g., very high temperature), (3) improve producibility and yield, and (4) identify and characterize the radiation and reliability response of these devices and associated materials. The development of enhance reliability, producibility, and yield will support the commercial semiconductor sector. In addition, the development of methods to improve the survivability of microelectronics in severe stressing environments is directly related to the commercial semiconductor and electronics industries.

During Phase I, the research will demonstrate the feasibility of the proposed technology and methods concepts.

During Phase II, the research concepts developed in Phase I will be demonstrated or reduced to engineering practice.

COMMERCIAL POTENTIAL: Microelectronics, Satellites

DNA 94-024 TITLE: Standard Set of Objects for Radio Frequency (RF) Testing

CATEGORY: Exploratory Development, Survivability and Hardening

OBJECTIVE: To formulate and promulgate a standardize, generic set of objects to facilitate RF upset/damage concept

assessment.

DESCRIPTION: Select a standardize, generic set of electronics based upon availability, cost, and military significance to promulgate for standardized RF test comparison. This set of unclassified objects will be used to compare source and effects testing results. Most tests are one of a kind because they are accomplished with one of a kind objects. This test set would provide a low cost method for initial assessment while being comparable with other tests.

During Phase I, initial feasibility studies will be conducted to select types of end quantities of objects.

During Phase II, the proposed test set will be subjected to rigorous examination and testing to ensure the necessary inherent qualities are present to support generic RF testing.

COMMERCIAL POTENTIAL: Electromagnetic Interference/compatibility testing.